

THE LIFE HISTORY AND BIOLOGY OF *EUPLOEA ALCATHOE ENASTRI* FENNER (LEPIDOPTERA: NYMPHALIDAE) FROM NORTHEASTERN ARNHEM LAND, NORTHERN TERRITORY, AUSTRALIA

MICHAEL F. BRABY

Biodiversity Conservation Division, Department of Natural Resources, Environment, the Arts and Sport, PO Box 496, Palmerston, NT 0831 and School of Botany and Zoology, The Australian National University, Canberra, ACT 0200

Abstract

The life history and general biology are described and illustrated for *Euploea alcatheae enastri* Fenner, which is endemic to Gove Peninsula in northeastern Arnhem Land, Northern Territory. The larval food plants include *Parsonsia alboflavescens*, *Gymnanthera oblonga* and *Marsdenia glandulifera* (Apocynaceae) growing in relatively small patches of mixed paperbark tall open forest with rainforest elements in the understorey, usually in juxtaposition to wet monsoon forest (evergreen vine-forest), or in the ecotone between wet evergreen vine-forest and savanna woodland or paperbark woodland (*i.e.* rainforest edge); both habitats are associated with perennial groundwater seepages or springs in lowland coastal areas that may be flooded seasonally. *P. alboflavescens*, which likewise is restricted to Gove Peninsula, appears to be the preferred food plant. Adults appear to breed throughout the year and the life cycle from egg to adult is completed in about four weeks during the dry season. The early stages are briefly compared with those of *E. a. misenus* Miskin and *E. core corinna* (W.S. Macleay).

Introduction

The Gove Crow butterfly, *Euploea alcatheae enastri* Fenner, 1991 (Fig. 2), is endemic to the Northern Territory, where it is restricted to Gove Peninsula of northeastern Arnhem Land (Fenner 1991, 1992; Braby 2006), a remote and relatively pristine area of the 'Top End' (Woinarski *et al.* 2007). It is one of three subspecies currently recognised from Australia and its adjacent islands under the polytypic taxon *E. alcatheae* (Godart, [1819]) *sensu lato*, the others being *E. a. misenus* Miskin, 1890, from Torres Strait and *E. a. eichhorni* Staudinger, 1884, from Cape York Peninsula, Queensland (Braby 2000, Lambkin 2001, 2005). There is some evidence from the early stages to indicate that the most widely distributed subspecies, *E. a. eichhorni*, may actually be specifically distinct from *E. alcatheae* (Lambkin 2001), although Ackery and Vane-Wright (1984) were unable to find definite autapomorphies to define either *E. eichhorni* or the species *E. alcatheae*. *E. alcatheae* itself is most closely related to *E. climena* (Stoll, [1782]), another taxon which is poorly defined morphologically (Ackery and Vane-Wright 1984).

The life history of *E. alcatheae sensu stricto* has been well documented for subspecies *E. a. misenus* (Lambkin 2001), but the larval food plants, early stages and general biology of *E. a. enastri* have not been recorded previously. *E. a. enastri* males typically occur within or near the edge of patches of wet monsoon forest and have been collected feeding at flowers of *Leea rubra* Blume (Leeaceae) during the wet season, whereas females have been observed outside the monsoon forest, up to 20 m from the edge, feeding on *Melaleuca* flowers or seeking oviposition sites (Fenner 1991). For *E. a.*

misenus, the natural larval food plant in the northern Torres Strait Islands is *Gymnanthera oblonga* (Burm.f.) P.S.Green (Lambkin 2001), but adults have also been reared from pupae collected from the ornamental Oleander, *Nerium oleander* L. (Johnson and Valentine 1997). *G. oblonga* and *N. oleander* both belong to the milkweed family Apocynaceae, which now includes the Asclepiadaceae (APG II 2003). For *E. a. enastri*, Fenner (1991) observed a female apparently ovipositing on the young shoots of a vine, tentatively identified as *Tylophora benthamii* Tsiang (Apocynaceae), growing in rainforest edge about five metres above ground level. Subsequently, eggs, assumed to be those of *E. a. enastri*, were found on the underside of leaves of *T. benthamii* growing in swampland at the margin of monsoon forest at Gurrumuru, NT, in April 2003 (R.P. Weir and C. Wilson, pers. comm.) but the larvae failed to hatch. More recently, a female was observed ovipositing on *G. oblonga* at Rocky Bay, NT, in August 2005 and the early stages were subsequently reared to adult on this plant (L. Wilson, pers. comm.).

The purpose of this report is to document the life history and general biology of *E. a. enastri* and to clarify its larval food plants and breeding habitat. I also briefly compare the morphology of the early stages of *E. a. enastri* with those of *E. a. misenus* and *E. core corinna* (W.S. Macleay, 1826) and comment on the systematic relationships of the taxon within the *E. alcatheae* complex.

Materials and methods

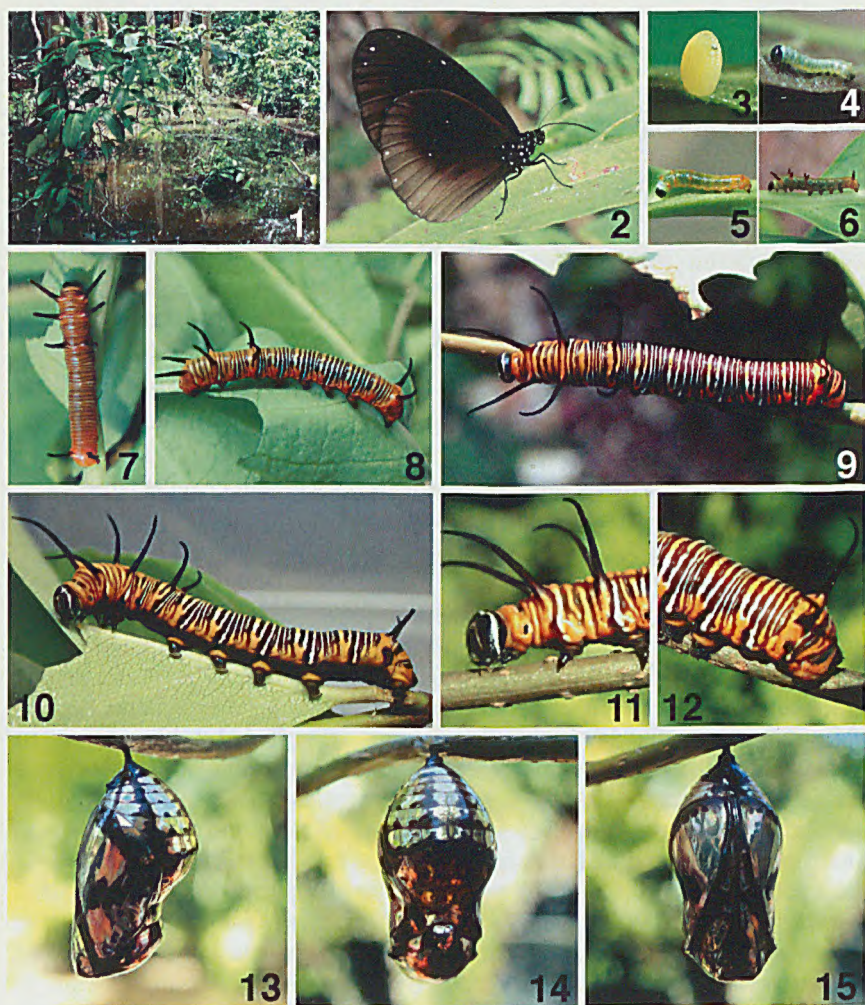
The following descriptions, illustrations and biological notes of the early stages of *E. a. enastri* are based on material collected from Gove Peninsula, NT. Most observations were made at a site near Yirrkala, Rocky Bay, in 2006 and 2007, with additional observations from sites at Gurrumuru, near Mt Bonner and Dhurputjpi in 2007 and 2008. The early stages of *E. a. enastri* were collected from the field and transported to Nhulunbuy or Darwin where they were reared in captivity on *G. oblonga* or *Parsonsia alboflavescens*. In addition, a small sample of females ($n = 6$) was collected from various populations on Gove Peninsula (Gapuwiyak, Gurrumuru, Rocky Bay) during the early dry season in June 2006 and August 2007 and dissected in the laboratory to ascertain their reproductive condition.

Life history

Larval food plants. *Parsonsia alboflavescens* (Dennst.) Mabb. (Fig. 1), *Gymnanthera oblonga* (Burm.f.) P.S.Green (Fig. 16), *Marsdenia glandulifera* C.T. White (Apocynaceae).

Egg (Fig. 3). 1.8 mm long; pale yellow; elongate and barrel-shaped, with apex somewhat flattened, and a series of approximately 20 longitudinal ribs and finer transverse lines.

First instar larva (Figs 4, 5). 7 mm long; head shiny black; body initially yellow on eclosion changing to semi-translucent orange-green after consuming food, with a darker green middorsal line and pair of small dull



Figs 1-15. Life history of *Euploea alcaethoe enastri* from Gove Peninsula, NT: (1) larval food plant *Parsonsia albosflavescens* (in left foreground) growing in seasonally flooded mixed paperbark tall open forest with rainforest elements in the understorey, Rocky Bay; (2) adult male, Gurrumuru; (3) egg; (4) first instar larva, newly eclosed; (5) first instar larva, after feeding; (6) second instar larva, lateral view; (7) third instar larva, dorsal view; (8) fourth instar larva, dorsolateral view; (9-12) final instar larva, showing dorsal view, lateral view, anterior end depicting head and thoracic segments, and posterior end depicting abdominal segments 5-10; (13-15) pupa, showing lateral, dorsal and ventral views. Photos © M.F. Braby.

reddish-brown protuberances on mesothorax, metathorax and abdominal segments 2 and 8.

Second instar larva (Fig. 6). 15 mm long; head shiny black; body orange-brown to greenish-orange, with four pairs of short black fleshy dorsolateral filaments, one on each of mesothorax, metathorax and abdominal segments 2 and 8; prothorax with a pair of small black dorsal spots.

Third instar larva (Fig. 7). 26 mm long; head black, with a faint white transverse band; body orange, with four pairs of long black dorsolateral fleshy filaments on mesothorax, metathorax, abdominal segment 2 and abdominal segment 8; prothorax with two black subdorsal patches; abdominal segments 1-7 each with a series of faint white and black transverse bands; spiracles black.

Fourth instar larva (Fig. 8). 30 mm long; similar to fifth instar, but transverse bands less well developed.

Fifth instar larva (Figs 9-12). 50-55 mm long; head black, with a white transverse band, and a white inverted Y-shaped mark on adfrontal suture; prothorax orange, with a black subdorsal patch; meso- and metathorax each with two long black dorsolateral fleshy filaments (7-9 mm long), and a series of narrow black transverse bands broadly edged with orange, the middle orange transverse band white in lateral area; abdominal segments 1-7 each with an alternating series of six black and five white transverse dorsal bands, with the middle white transverse band extending to ventrolateral region, white transverse bands frequently orange or suffused with orange in middorsal area particularly on segments 1 and 2, a broad broken and irregular orange lateral band, and a pair of black dorsolateral fleshy filaments on segment 2; abdominal segment 8 orange, edged posteriorly with a narrow white transverse band and then a black transverse band, and with a pair of black dorsolateral fleshy filaments; abdominal segment 9 predominantly orange, narrowly edged with black transverse bands; abdominal segment 10 orange, with anal plate black; ventral surface black; legs and prolegs black, with basal area orange; spiracles black.

Pupa (Figs 13-15). 20-21 mm long, 9 mm wide; initially translucent pink, but after 24 hrs changes to shining silver with dark brown markings on wing cases and abdomen, or gold with pale brown markings on wing cases and abdomen; antennae and cremaster brown; spiracles black.

Biology

Adults of both sexes of *Euploea alacathoe enastri* were recorded in a variety of habitats on Gove Peninsula, including closed monsoon forest (i.e. wet evergreen vine-forest); rainforest edge (i.e. the ecotone between wet evergreen vine-forest and savanna woodland or paperbark woodland); mixed paperbark tall open forest or woodland (dominated by *Melaleuca leucadendra* (L.) L. or *M. cajuputi* Powell) with rainforest elements in the

understorey, usually in juxtaposition to wet evergreen vine-forest; and paperbark woodland (dominated by *Melaleuca* spp.) with pandanus (*Pandanus spiralis* R.Br.) in the understorey or mixed paperbark-pandanus woodland (M.F. Braby unpublished data). However, the larval food plants (Fig. 1) or early stages of *E. a. enastri* were found in only two of these habitats: the seasonally flooded mixed paperbark tall open forest with rainforest elements in the understorey, and rainforest edge that is less seasonally inundated with water. In both habitats, the breeding areas comprised relatively small patches of open forest or tall open forest associated with perennial groundwater seepages or springs in lowland coastal plains, usually surrounded by savanna woodland, paperbark woodland or sometimes open grassland floodplain depending upon hydrology.

The early stages of *E. a. enastri* were found on three species of plants at four locations on Gove Peninsula (Table 1). The main food plant, based on the frequency of field records, appeared to be *Parsonsia alboflavescens* (78% of all records) (Fig. 1), although the sample size was small ($n = 9$). Only single observations were available for the two other species. Larvae were found to readily consume *Gymnanthera oblonga* when reared in captivity regardless of the initial food plant on which eggs or larvae were associated. Although only eggs were found on *Marsdenia glandulifera*, there seemed little reason to doubt the suitability of this plant given that it is native to Australia and the general specialisation of *Euploea* Fabricius butterflies on vines in the Apocynaceae.

Females laid their eggs singly on the upperside or underside of new, small soft leaves growing near the apex of the larval food plant. Host suitability by ovipositing females involved a slow, hovering flight around the foliage of the food plant, followed by alighting on the upper surface of the leaves. This behaviour would be repeated many times until a leaf was eventually found suitable on which to deposit an egg. Such behaviour suggested that both visual and tactile cues were used to determine host suitability. Following hatching, the newly emerged larva consumed the chorion before proceeding to notch the mid vein of the leaf or graze a small semi-circular section from near the margin of an adjacent larger leaf. The first instar larva then proceeded to eat whole sections of leaf tissue from the margin of the new soft developing leaf on which the egg was initially laid. During development, the early instar larvae ate in short bursts and, when not feeding or moulting, retreated lower down on the vine to rest on the underside of a larger mature leaf. Later instar larvae also ate in bursts on young but fully expanded leaves; between meals, they remained on the underside of the same leaf being consumed. In captivity, all larval instars were noted to consume only the younger leaves and were reluctant to eat older leaves. Before consuming a leaf, a fine silken trail was laid over the surface to aid in mobility. Larvae were also observed to eat the cast larval skin after each moult. Prior to pupation, the final instar larva spun a silken platform on the underside of a

Table 1. Summary of field observations on the larval food plants and early stages of *Euploea alcaethoe enastri*. LFP = larval food plant.

Larval food plant	Early stages	Locality / observer
<i>Gymnanthera oblonga</i>	Female observed ovipositing on LFP in Aug. 2005; several adults reared in captivity on <i>G. oblonga</i> .	5 km SSE of Yirrkala, Rocky Bay. L. Wilson
<i>Marsdenia glandulifera</i>	2 eggs collected from underside of new soft leaves of LFP on 3.ix.2007; 1 female reared in captivity on <i>G. oblonga</i> (larva pupated 19.ix.2007; adult emerged 28.ix.2007).	5.5 km NW of Mt Bonner. M.F. Braby, P. Wise & B. Marika
<i>Parsonsia alboflavescens</i>	5 eggs and early instar larvae collected from upper and underside of leaves of LFP on 22.iii.2006; 2 adults reared in captivity on <i>G. oblonga</i> .	5 km SSE of Yirrkala, Rocky Bay. M.F. Braby & L. Wilson
<i>Parsonsia alboflavescens</i>	Female observed ovipositing a single egg on upperside of new soft leaf of large vine of LFP at 1130 hrs on 3.vii.2006; a second female observed ovipositing on a different vine of LFP at 1215 hrs; a third female inspected another vine of LFP for suitability at 1230 hrs but did not oviposit; 1 male reared in captivity on <i>G. oblonga</i> (egg hatched 5.vii.2006; larva pupated 21.vii.2006; adult emerged 31.vii.2006).	5 km SSE of Yirrkala, Rocky Bay. M.F. Braby
<i>Parsonsia alboflavescens</i>	3 eggs collected from underside of new soft leaves of LFP on 30.viii.2007; adults reared in captivity on <i>P. alboflavescens</i> .	5 km SSE of Yirrkala, Rocky Bay. M.F. Braby, P. Wise & B. Marika
<i>Parsonsia alboflavescens</i>	1 dead pupa collected suspended beneath leaf of <i>Horsfieldia australiana</i> c. 1 m above ground level and 2 m from large vine of LFP on 31.viii.2007; 3 adult <i>Euploea darchia</i> feeding from contents of pupa.	5 km SSE of Yirrkala, Rocky Bay. M.F. Braby & P. Wise
<i>Parsonsia alboflavescens</i>	1 pupal exuvia collected from beneath broad leaf of <i>Carallia brachiata</i> c. 1 m above ground level, around which the LFP grew, on 31.viii.2007.	5 km SSE of Yirrkala, Rocky Bay. M.F. Braby & P. Wise
<i>Parsonsia alboflavescens</i>	1 egg collected from underside of new soft leaf of LFP on 20.vi.2007 and reared to instar IV in captivity on <i>P. alboflavescens</i> (egg hatched 22.vi.2007; larva moulted to instar II 24.vi.2007, instar III 26.vi.2007).	Goromuru River, 1.5 km WNW of Gurrumuru outstation, Arnhem Bay. M.F. Braby
<i>Parsonsia alboflavescens</i>	1 egg collected from underside of new soft leaf of LFP comprising small vine growing on forest floor on 2.x.2008; male reared in captivity on <i>P. alboflavescens</i> (egg hatched 3.x.2008; larva pupated 18.x.2008; adult emerged 26.x.2008).	5 km W of Dhurputjipi outstation. M.F. Braby & S. Gregg

leaf to which the pupa was attached by the cremaster and suspended upside down. In the field, pupae were not detected on the larval food plant, but were found on the underside of large leaves of two rainforest trees (non-larval food plants) growing adjacent to *P. alboflavescens* (Table 1), which suggests that larvae leave the food plant to pupate elsewhere. Final pupal colour appeared to be dependent upon the background colour. In captivity, adults emerged soon after dawn.

Males flew with a slow, gliding flight from around mid morning to mid afternoon in sunny glades, from within a few metres of ground level to near the canopy (10-30 m); during the cooler hours of the morning, late afternoon or when conditions were overcast, they were usually observed at rest in shade on the upper surface of large leaves. Both sexes were observed feeding avidly from flowers from a range of plants, often high up in the canopy, particularly *Melaleuca* spp. in the early dry season, but also *Carallia brachiata* (Lour.) Merr. in late August-early September (during early to mid afternoon), *Marsdenia geminata* (R.Br.) P.I.Forst. (Apocynaceae) in late September (at 1100-1130 hrs), *Ixora timorensis* Decne. (Rubiaceae) in late September (at 0920 hrs), and *Vavaea australiana* S.T.Blake (Myrsinaceae) in early October (at 1615-1630 hrs). A pair was observed flying *in copula* in late August 2007 at 1350 hrs at a breeding site at Rocky Bay.

Adults were recorded during most months of the year except November and January, two months that were not sampled in the present study. Limited observations on ovipositing females, mating and the temporal occurrence of the early stages (Table 1) indicated that breeding occurred from at least March to October. However, unlike other danaines, such as *E. core corinna*, *E. sylvester pelor* Doubleday, 1847 and *E. darchia darchia* (W.S. Macleay, 1826), with which it co-occurred, *E. a. enastri* did not form large overwintering clusters during the dry season, although small numbers were sometimes found aggregated in paperbark woodland close to the breeding areas, but only during June and July. Of the sample of females collected during the early dry season and dissected in the laboratory to assess their reproductive status, four individuals (67%) had no chorinated eggs in the oviduct but the ovaries contained eggs in various stages of development, while two individuals (33%) had small numbers of eggs (1-2) present in the oviduct. However, the body cavity of all individuals contained large amounts of yellow fat bodies, and each specimen contained several large intact spermatophores.

A male reared on *G. oblonga* in captivity at Darwin, from an egg laid in early July 2006, completed its life cycle in 28 days, and another male reared on *P. alboflavescens* in captivity at Darwin, from an egg collected in early October 2008, completed development in 23 days (excluding egg) (Table 1). Similarly, a female reared on *G. oblonga* at Nhulunbuy, from an egg collected in early September 2007, completed development in 25 days

(excluding egg) (Table 1). The overall duration of the early stages was as follows: egg 2 days, larva 15-16 days (duration of instars: I 2 days, II 2 days, III 1-2 days, IV 2 days, V 8 days), pupa 8-10 days. The longevity of adults was not determined but, like other danaines, they are probably long-lived, possibly up to six months or more (Ackery and Vane-Wright 1984).

Discussion

Observations made on Gove Peninsula indicate that *Euploea alcatheae enastri* utilises at least three native larval food plants, of which one is shared with *E. a. misenus*. Further work is needed to determine the relative frequency of usage among these plants, and to confirm if *Tylophora benthamii* is also used, but preliminary observations suggest that *Parsonsia alboflavescens* is the preferred host. Within Australian limits, *P. alboflavescens* is restricted to northeastern Arnhem Land, NT, where it grows as a scrambling vine or tall climber with twining stems (Forster and Williams 1996); on Gove Peninsula it was only found in rainforest edge (i.e. the ecotone between wet evergreen vine-forest and paperbark woodland or savanna woodland) and the seasonally flooded mixed paperbark tall open forest with rainforest elements in the understorey where the vine frequently ascended the canopy via the trunks of paperbarks, particularly in long-unburnt sites. In contrast, *Marsdenia glandulifera* is endemic to northern and eastern Australia, occurring from the Kimberley across the Top End to Cape York Peninsula, as well as in southeastern Queensland, where it grows as a woody vine with white latex, often in rainforest swamps (Forster *et al.* 1996). *Gymnanthera oblonga* is also widely distributed and occurs in wider array of habitats throughout northern Australia in flooded coastal areas, such as edges of mangroves and along watercourses, where it grows as a tropical woody scrambler or liana (Forster *et al.* 1996). *T. benthamii*, which closely resembles *M. glandulifera*, except is characterised by yellow latex, is reasonably widespread in vine-forests in the Top End and occurs patchily in coastal rainforest areas of Queensland; it also grows as a woody liana (Forster *et al.* 1996). Thus, of the four potential larval food plants, one is restricted in range while the three others occur more widely outside the natural range of *E. a. enastri*. This suggests that the butterfly may be opportunistic, breeding on a suite of vines in the Apocynaceae that are locally available. On the other hand, if *P. alboflavescens* proves to be the primary food plant of *E. a. enastri*, then the other species may serve to supplement the diet, particularly if new growth of *P. alboflavescens* is temporally or spatially limited. If *P. alboflavescens* is indeed the preferred larval food plant then the limited occurrence of this species in the Top End may partly explain the restricted occurrence of the butterfly to northeastern Arnhem Land.

Little information on the ecology, behaviour and reproductive biology of *E. a. enastri* has previously been recorded, although some details have been documented for the closely related *E. a. misenus* (Lambkin 2001). The life

cycle of *E. a. misenus*, from egg to adult, is completed in approximately four weeks during March (Lambkin 2001), which agrees with observations made on *E. a. enastri* in which the life cycle is also completed in about four weeks during July–October. Limited observations on ovipositing females, mating behaviour and the temporal occurrence of the early stages suggest that breeding on Gove Peninsula occurs continuously from at least the late wet season (March) to the mid dry season (October). Adults of several other species of *Euploea* and *Tirumala hamata* (W.S. Macleay, 1826) are known to migrate and/or aggregate in large numbers during the winter-dry season in northern Australia (Monteith 1982, Kitching and Scheermeyer 1993, Scheermeyer 1993, 1999). Many of these species, including *E. sylvester* (Fabricius, 1793), *E. tulliolus* (Fabricius, 1793), *E. core* (Cramer, [1780]) (Fig. 17) and probably *E. darchia*, stop breeding during the dry season. It is not known if breeding in *E. alcatheae sensu stricto* is also seasonal, or if females enter reproductive diapause during the late dry season. However, limited observations made on the reproductive condition of *E. a. enastri* females and aggregation behaviour in non-breeding habitats during June–July, suggest that reproductive activity declines with the onset of the cooler winter dry season, but females do not stop breeding and enter reproductive diapause. Further field observations and comparative data for the late dry season (November–December) and early wet season (January–February), however, are needed to confirm this supposition. Lambkin (2001) noted that adults of *E. a. misenus* were most abundant during the wet season, from December to May, and suggested that breeding for this subspecies is limited to this period. He observed that the early instar larvae were dependent upon the young, soft foliage of the larval food plant, which is seasonally available in the late wet season. Although the climate is strongly monsoonal with most of the rain falling between November and April, the dry season in northeastern Arnhem Land is less pronounced and severe, being characterised by cooler and more humid conditions compared with the rest of the Top End, Torres Strait and northern Cape York Peninsula, so that the larval food plants continue to produce new growth at this time. Hence, it is likely that *E. a. enastri* breeds throughout the year.

Several species-groups of *Euploea* butterflies, including *E. alcatheae sensu lato*, are taxonomically complex and morphological data from their early stages may help elucidate their status and systematic relationships. The early stages of *E. a. enastri* provides additional characters for comparison with those reported for other subspecies in Australia, particularly *E. a. misenus* (which is well known) from the Torres Strait Islands (Lambkin 2001) and *E. a. eichhorni* (which is poorly known) from Cape York Peninsula (McCubbin 1971). The early stages of *E. a. enastri* are identical to the general descriptions and illustrations given for *E. a. misenus* (Lambkin 2001) but seem to differ from those of *E. a. eichhorni*. Several differences between the final instar larvae of *E. a. misenus* and *E. a. eichhorni* were noted by



Figs 16-27. Life history of *Euploea core corinna* from the Top End, NT: (16) larval food plant *Gymnanthera oblonga* (in left foreground) growing in paperbark woodland, Adelaide River; (17) adult male, Darwin; (18) egg; (19) third instar larva, dorsal view; (20-24) final instar larva, showing dorsolateral view, dorsal view, lateral view, anterior end depicting head and thoracic segments, and posterior end depicting abdominal segments 6-10; (25-27) pupa, showing lateral, dorsal and ventral views. Photos figs 16, 18-27 © M.F. Braby, fig. 17 © A. Hope.

Lambkin (2001), particularly in the body colour, pattern of transverse bands, relative length of the black fleshy filaments on the metathorax and abdominal segments 2 and 8, and presence of a white lateral band (which is absent in *E. alcaethoe sensu stricto*). This suggests that *E. a. misenus* may be more closely related to *E. a. enastri* than to *E. a. eichhorni*, despite the fact that *E. a. misenus* and *E. a. eichhorni* both occur in northern Queensland and are separated geographically from *E. a. enastri* by the Gulf of Carpentaria.

The early stages of *E. a. enastri* are similar to those of *E. core corinna* (Figs 16-27) and, to some extent, *E. sylvester pelor* (Meyer 1997), two species which breed on similar larval food plants in the same habitat as *E. a. enastri* in northeastern Arnhem Land (M.F. Braby, unpublished data). While the early stages of *E. alcaethoe sensu stricto* and allied taxa, including *E. c. corinna*, are very similar morphologically, Lambkin (2001) noted that the final instar larva of *E. a. misenus* was characterised by an extensive orange colouration, with the white markings less extensive or poorly developed. The following comparative differences in the final instar larva and pupa of *E. a. enastri* and *E. c. corinna* are provided to enable separation of the two species in the field. The larva of *E. c. corinna* (Figs 20-24) has a narrow but conspicuous white lateral band along the length of the body (sometimes this band is broken into a series of spots – see Fig. 22), whereas in *E. a. enastri* this band is absent. In *E. a. enastri*, the middle white transverse dorsal band, of the five bands on each body segment (from the mesothorax to abdominal segment 7), extends to the ventrolateral region, whereas in *E. c. corinna* this band stops well before the broad orange lateral band. In *E. c. corinna*, the pair of black fleshy filaments on the mesothorax, metathorax and abdominal segments 2 and 8 arise from a white patch and/or the basal area of the filaments is white (Figs 23, 24), whereas in *E. a. enastri* the basal area of the filaments is generally pale orange and the filaments arise from an orange patch on the segment (Figs 11, 12). The pupa of *E. a. enastri* is substantially larger, with the brown markings often darker, than that of *E. c. corinna* (Figs 25-27).

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